

APPENDIX A

DETAILED ANALYSIS TABLES

Table A-1. Expenditures and percentage distribution for the purchase of academic research instrumentation in the biological sciences, by source of funds: 1983-93

[Dollars in millions]

Source of funds	Survey year							
	1983		1986		1989		1993	
	Dollars	Percent	Dollars	Percent	Dollars	Percent	Dollars	Percent
Total.....	130	100	185	100	256	100	283	100
Federal sources, total.....	63	48	101	54	NA	NA	110	39
National Science Foundation.....	NA	NA	NA	NA	NA	NA	18	6
National Institutes of Health.....	NA	NA	NA	NA	NA	NA	85	30
Department of Defense.....	NA	NA	NA	NA	NA	NA	1	1
Department of Energy.....	NA	NA	NA	NA	NA	NA	1	+
Other.....	NA	NA	NA	NA	NA	NA	5	2
Non-Federal sources, total.....	67	52	85	46	NA	NA	173	61
Institution funds.....	40	31	42	23	NA	NA	111	39
State government.....	10	8	20	11	NA	NA	16	6
Industry.....	4	3	5	3	NA	NA	14	5
Other.....	13	10	18	9	NA	NA	33	12

NOTE: Because of rounding, details may not add to totals.

KEY: + = less than 0.5 percent
NA = not ascertained in that survey year

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-2. Perceived adequacy of maintenance/repair on research instruments, by field of biological science, type of institution, and institutional control: 1994

[Percentage]

Field of biological science, type of institution, and institutional control	Perceived adequacy of maintenance/repair					Mean rating 1/
	Excellent		Adequate		Poor	
	(1)	(2)	(3)	(4)	(5)	
All biological sciences.....	5	25	47	19	3	2.9
Research field:						
Biochemistry.....	4	37	23	13	23	3.1
Cell biology/genetics.....	15	9	62	11	2	2.7
Microbiology.....	16	34	35	15	0	2.5
Pathology.....	*	*	*	*	*	*
Pharmacology.....	*	*	*	*	*	*
Physiology/biophysics.....	0	3	79	18	0	3.2
Other biology, general.....	0	28	50	21	1	3.0
Type of institution:						
Medical schools, total.....	9	34	38	19	+	2.7
Public.....	8	31	38	22	+	2.7
Private.....	12	45	38	6	0	2.4
Colleges and universities, total.....	2	16	56	20	6	3.1
Public.....	2	17	51	21	8	3.2
Private.....	0	16	70	14	0	3.0

1/ Perceived adequacy of maintenance/repair was rated on a scale of 1 (excellent) to 5 (poor).

NOTE: Because of rounding, percentages may not add to 100.

KEY: + = less than 0.5 percent
* = insufficient number of cases for analysis

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-3. Perceived change in instrument needs over the last two years, by field of biological science, type of institution, and institutional control: 1994

(Percentage)

Field of biological science, type of institution, and institutional control	Perceived change in instrument needs					Mean rating <u>1/</u>
	Substantially increased	Increased	Remained about the same	Decreased	Substantially decreased	
	(1)	(2)	(3)	(4)	(5)	
All biological sciences.....	19	48	32	1	0	2.1
Research field:						
Biochemistry.....	12	45	44	0	0	2.3
Cell biology/genetics.....	20	70	10	0	0	1.9
Microbiology.....	2	69	27	2	0	2.3
Pathology.....	*	*	*	*	*	*
Pharmacology.....	*	*	*	*	*	*
Physiology/biophysics.....	54	23	19	4	0	1.7
Other biology, general.....	15	49	36	0	0	2.2
Type of institution:						
Medical schools, total.....	25	41	35	0	0	2.1
Public.....	25	35	40	0	0	2.2
Private.....	23	63	14	0	0	1.9
Colleges and universities, total....	14	55	29	2	0	2.2
Public.....	15	51	32	2	0	2.2
Private.....	10	71	19	0	0	2.1

1/ Perceived change in instrumentation needs was rated on a scale of 1 (substantially increased) to 5 (substantially decreased).

NOTES: Perceived change in instrumentation needs refers to the period 1992 to 1994.

Because of rounding, percentages may not add to 100.

KEY: + = less than 0.5 percent
* = insufficient number of cases for analysis

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-4. Percentage distribution of requested instruments in the biological sciences, by type of instrument requested and level of priority: 1994

[Percentage]

Type of instrument requested	Priority one	Priority two	Priority three
Total, all instruments.....	100	100	100
Computers and data handling instruments...	14	14	9
Chromatographs and spectrometers.....	14	26	14
Microscopy instruments.....	19	10	14
Bioanalytical instruments.....	41	40	50
Other instruments.....	12	10	13

NOTES: Because of rounding, percentages may not add to 100.
Percentages are based on cost per item rather than number of instruments.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-5. Total cost to purchase the highest priority item requested in the biological sciences, by type of instrument requested and field of biological science: 1994

[Dollars in thousands]

Type of instrument requested	Field of biological science							
	All biological sciences	Bio-chemistry	Cell biology/genetics	Micro-biology	Pathology	Pharmacology	Physiology/biophysics	Other biological sciences
Total, all instruments.....	162,801	65,653	7,780	10,106	4,946	4,788	17,559	51,970
Computers and data handling instruments...	15,165	2,104	918	1,049	406	78	3,903	6,707
Graphics/CAD/imaging computer systems...	11,285	1,918	86	0	0	78	3,903	5,301
Other computers > \$50K.....	3,098	116	451	1,049	406	0	0	1,077
Other computers/components < \$50K.....	782	71	381	0	0	0	0	330
Chromatographs and spectrometers.....	62,404	53,814	0	800	0	1,108	778	5,904
Electron/aufer/ion scattering.....	0	0	0	0	0	0	0	0
Electron spectroscopy/photo-induced emission elemental analyzers.....	623	0	0	0	0	0	0	623
NMR/EPR spectrometers.....	40,464	39,071	0	0	0	292	0	1,101
UV/visible/infrared spectrophotometers..	55	0	0	0	0	0	0	55
Xray diffraction systems.....	8,862	7,268	0	0	0	817	778	0
Chromatographs and elemental analyzers..	3,659	0	0	0	0	0	0	3,659
Other spectroscopy instruments.....	8,741	7,475	0	800	0	0	0	465
Microscopy instruments.....	36,270	0	1,752	0	2,991	1,854	5,979	23,694
Electron microscopes.....	10,781	0	256	0	2,991	1,854	0	5,680
Other microscopy instruments.....	25,488	0	1,495	0	0	0	5,979	18,014
Bioanalytical instruments.....	35,850	9,518	2,767	8,257	1,394	1,747	3,215	8,951
Cell sorters/counters, cytometers.....	3,098	0	371	1,484	0	0	934	308
Centrifuges and accessories.....	10,400	55	51	1,567	790	0	2,280	5,656
DNA/protein synthesizers/sequencers/analyzers.....	17,610	8,352	2,001	4,364	605	0	0	2,288
Growth/environmental chambers.....	1,291	0	0	661	0	0	0	630
Scintillation/gamma radiation/counters/detectors.....	3,452	1,111	343	181	0	1,747	0	69
Other instruments.....	13,112	216	2,343	0	154	0	3,685	6,713
Electronics instruments (cameras, etc)..	2,089	0	752	0	0	0	1,337	0
Temperature/pressure control/measurement instruments.....	0	0	0	0	0	0	0	0
Lasers and optical instruments.....	2,339	0	0	0	0	0	909	1,430
Robots, manufacturing machines.....	0	0	0	0	0	0	0	0
Major instruments (telescopes, ships, nuclear reactors, wind tunnels, etc)..	0	0	0	0	0	0	0	0
Other, not elsewhere classified.....	8,684	216	1,592	0	154	0	1,439	5,284

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-6. Total cost to purchase the top three priority items needed in the biological sciences, by type of instrument requested and field of biological science: 1994

[Dollars in thousands]

Type of instrument requested	Field of biological science							
	All biological sciences	Bio-chemistry	Cell biology/genetics	Micro-biology	Pathology	Pharma-cology	Physi-ology/biophysics	Other biological sciences
Total, all instruments.....	363,263	124,798	28,027	22,202	12,727	12,429	31,611	131,469
Computers and data handling instruments...	33,616	4,123	1,258	1,230	4,113	362	4,973	17,557
Graphics/CAD/imaging computer systems...	16,533	3,627	195	0	906	138	4,304	7,363
Other computers > \$50K.....	12,123	309	451	1,230	714	127	669	8,624
Other computers/components < \$50K.....	4,959	187	612	0	2,493	96	0	1,570
Chromatographs and spectrometers.....	136,770	100,506	3,252	988	272	6,308	2,968	22,476
Electron/aufer/ion scattering.....	0	0	0	0	0	0	0	0
Electron spectroscopy/photo-induced emission elemental analyzers.....	623	0	0	0	0	0	0	623
NMR/EPR spectrometers.....	81,782	70,590	1,157	0	0	3,417	389	6,229
UV/visible/infrared spectrophotometers..	4,086	161	176	0	0	359	836	2,554
Xray diffraction systems.....	20,829	15,788	0	0	0	817	1,322	2,902
Chromatographs and elemental analyzers..	14,300	4,122	1,919	188	272	1,113	171	6,515
Other spectroscopy instruments.....	15,150	9,845	0	800	0	603	249	3,653
Microscopy instruments.....	59,318	0	8,721	1,566	4,044	1,917	7,467	35,603
Electron microscopes.....	21,375	0	5,364	0	2,991	1,854	0	11,166
Other microscopy instruments.....	37,943	0	3,357	1,566	1,053	64	7,467	24,437
Bioanalytical instruments.....	96,461	15,595	12,074	18,152	3,500	3,453	9,372	34,315
Cell sorters/counters, cytometers.....	16,283	778	1,451	6,456	2,106	0	934	4,558
Centrifuges and accessories.....	18,443	971	2,726	1,567	790	240	3,619	8,531
DNA/protein synthesizers/sequencers/analyzers.....	35,302	12,161	6,671	5,979	605	1,466	241	8,178
Growth/environmental chambers.....	12,658	0	193	2,302	0	0	1,673	8,490
Scintillation/gamma radiation/counters/detectors.....	13,775	1,684	1,033	1,848	0	1,747	2,905	4,558
Other instruments.....	37,099	4,574	2,721	266	798	389	6,832	21,518
Electronics instruments (cameras, etc)..	3,490	0	752	0	73	0	1,548	1,117
Temperature/pressure control/measurement instruments.....	370	107	0	0	0	0	0	263
Lasers and optical instruments.....	6,567	1,525	0	0	73	389	909	3,672
Robots, manufacturing machines.....	1,400	0	0	0	0	0	928	472
Major instruments (telescopes, ships, nuclear reactors, wind tunnels, etc)..	0	0	0	0	0	0	0	0
Other, not elsewhere classified.....	25,272	2,943	1,970	266	653	0	3,446	15,995

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-7. Median cost to purchase the highest priority item requested and percentage of respondents in the biological sciences requesting that item, by type of institution, institutional control, and major type of instrument: 1994

[Dollars]

Type of institution and institutional control	Major type of instrument											
	All instruments		Computers and data handling instruments		Chromatographs and spectrometers		Microscopy instruments		Bioanalytical instruments		Other instruments	
	Median cost	Percent of respondents	Median cost	Percent of respondents	Median cost	Percent of respondents	Median cost	Percent of respondents	Median cost	Percent of respondents	Median cost	Percent of respondents
Total, all biological sciences.....	80,000	100	60,000	14	200,000	14	150,000	19	60,000	40	90,000	12
Type of institution:												
Medical schools, total.....	100,000	100	70,000	16	280,000	15	150,000	22	80,000	31	77,500	15
Public.....	100,000	100	*	17	*	16	125,000	22	70,000	30	55,000	15
Private.....	100,000	100	*	13	*	12	*	21	*	38	*	15
Colleges and universities, total....	75,000	100	60,000	11	77,500	13	150,000	16	50,000	51	90,000	9
Public.....	75,000	100	60,000	10	72,500	14	162,500	13	42,500	54	92,500	9
Private.....	75,000	100	*	15	*	8	*	27	50,000	42	*	9

NOTE: Because of rounding, percentages may not add to 100.

KEY: * = insufficient number of cases for analysis

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-8. Total cost to purchase the highest priority item requested in the biological sciences, by type of instrument requested, type of institution and type of control: 1994

[Dollars in thousands]

Type of instrument requested	Type of institution						
	All institutions	Medical schools			Colleges and universities		
		Medical schools, total	Public	Private	Colleges and universities, total	Public	Private
Total, all instruments.....	162,801	64,473	45,714	18,759	98,328	58,367	39,961
Computers and data handling instruments...	15,165	9,947	8,319	1,629	5,218	3,970	1,248
Graphics/CAD/imaging computer systems...	11,285	7,711	6,534	1,178	3,574	3,265	309
Other computers > \$50K.....	3,098	1,906	1,455	451	1,192	634	558
Other computers/components < \$50K.....	782	330	330	0	452	71	381
Chromatographs and spectrometers.....	62,404	13,357	8,214	5,143	49,046	19,973	29,073
Electron/auger/ion scattering.....	0	0	0	0	0	0	0
Electron spectroscopy/photo-induced emission elemental analyzer.....	623	446	446	0	177	177	0
NMR/EPR spectrometer.....	40,464	3,448	625	2,823	37,016	7,942	29,073
UV/visible/infrared spectrophotometer...	55	0	0	0	55	55	0
Xray diffraction systems.....	8,862	8,091	5,771	2,320	771	771	0
Chromatographs and elemental analyzers..	3,659	637	637	0	3,023	3,023	0
Other spectroscopy instruments.....	8,741	736	736	0	8,005	8,005	0
Microscopy instruments.....	36,270	22,846	16,799	6,047	13,424	10,182	3,241
Electron microscopes.....	10,781	6,348	4,845	1,503	4,433	3,235	1,198
Other microscopy instruments.....	25,488	16,498	11,954	4,544	8,990	6,947	2,043
Bioanalytical instruments.....	35,850	10,232	6,692	3,539	25,619	20,763	4,855
Cell sorters/counters, cytometers.....	3,098	0	0	0	3,098	2,144	953
Centrifuges and accessories.....	10,400	4,942	3,789	1,153	5,458	4,716	742
DNA/protein synthesizers/sequencers/analyzers.....	17,610	3,848	2,122	1,726	13,762	12,093	1,669
Growth/environmental chambers.....	1,291	661	661	0	630	590	40
Scintillation/gamma radiation/counters/detectors.....	3,452	781	121	661	2,671	1,219	1,451
Other instruments.....	13,112	8,091	5,690	2,401	5,021	3,478	1,543
Electronics instruments (cameras, etc)..	2,089	2,089	1,337	752	0	0	0
Temperature/pressure control/measurement instruments.....	0	0	0	0	0	0	0
Lasers and optical instruments.....	2,339	909	909	0	1,430	0	1,430
Robots, manufacturing machines.....	0	0	0	0	0	0	0
Major instruments (telescopes, ships, nuclear reactors, wind tunnels, etc)..	0	0	0	0	0	0	0
Other, not elsewhere classified.....	8,684	5,093	3,444	1,650	3,591	3,478	113

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-9. Total cost to purchase the top three priority items requested in the biological sciences, by type of instrument requested, type of institution, and type of control: 1994

[Dollars in thousands]

Type of instrument requested	Type of institution						
	All insti- tutions	Medical schools			Colleges and universities		
		Medical schools, total	Public	Private	Colleges and universi- ties, total	Public	Private
Total, all instruments.....	363,263	174,320	124,617	49,703	188,943	123,213	65,731
Computers and data handling instruments...	33,616	20,853	17,807	3,046	12,763	10,483	2,280
Graphics/CAD/imaging computer systems...	16,533	9,449	8,271	1,178	7,084	5,992	1,092
Other computers > \$50K.....	12,123	8,137	6,386	1,752	3,986	3,428	558
Other computers/components < \$50K.....	4,959	3,267	3,150	117	1,693	1,063	630
Chromatographs and spectrometers.....	136,770	61,322	50,338	10,984	75,448	37,230	38,218
Electron/auuger/ion scattering.....	0	0	0	0	0	0	0
Electron spectroscopy/photo-induced emission elemental analyzers.....	623	446	446	0	177	177	0
NMR/EPR spectrometers.....	81,782	42,775	37,554	5,221	39,007	8,776	30,230
UV/visible/infrared spectrophotometers..	4,086	2,788	2,291	497	1,298	747	552
Xray diffraction systems.....	20,829	9,859	5,771	4,088	10,970	6,850	4,121
Chromatographs and elemental analyzers..	14,300	3,188	2,676	512	11,112	10,492	620
Other spectroscopy instruments.....	15,150	2,266	1,599	667	12,884	10,188	2,695
Microscopy instruments.....	59,318	35,383	21,425	13,957	23,935	16,227	7,709
Electron microscopes.....	21,375	13,325	6,576	6,749	8,050	5,085	2,964
Other microscopy instruments.....	37,943	22,058	14,849	7,209	15,886	11,141	4,744
Bioanalytical instruments.....	96,461	33,584	19,846	13,737	62,877	50,229	12,648
Cell sorters/counters, cytometers.....	16,283	6,646	3,762	2,883	9,637	5,836	3,802
Centrifuges and accessories.....	18,443	10,492	6,393	4,099	7,951	6,631	1,320
DNA/protein synthesizers/sequencers/ analyzers.....	35,302	8,084	2,388	5,696	27,218	22,710	4,508
Growth/environmental chambers.....	12,658	2,334	2,334	0	10,324	9,110	1,214
Scintillation/gamma radiation/counters/ detectors.....	13,775	6,028	4,969	1,059	7,747	5,943	1,804
Other instruments.....	37,099	23,179	15,200	7,979	13,920	9,043	4,877
Electronics instruments (cameras, etc)..	3,490	2,471	1,646	824	1,019	447	572
Temperature/pressure control/ measurement instruments.....	370	158	0	158	212	212	0
Lasers and optical instruments.....	6,567	2,462	2,000	462	4,105	1,595	2,510
Robots, manufacturing machines.....	1,400	196	196	0	1,204	1,204	0
Major instruments (telescopes, ships, nuclear reactors, wind tunnels, etc)..	0	0	0	0	0	0	0
Other, not elsewhere classified.....	25,272	17,893	11,358	6,535	7,379	5,584	1,795

NOTE: Because of rounding, details may not add to totals.

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994

Table A-10. Perceived availability of resources to operate current instruments,
by field of biological science, type of institution,
and institutional control: 1994

[Percentage]

rating	Field of biological science, type of institution, and institutional control	Perceived availability of resources				Mean <u>1/</u>
		Excellent		Adequate	Poor	
3.3	All biological sciences.....	3	9	50	31	6
	Research field:					
3.5	Biochemistry.....	0	8	41	43	8
3.3	Cell biology/genetics.....	0	17	34	49	0
2.6	Microbiology.....	20	12	51	16	0
*	Pathology.....	*	*	*	*	*
*	Pharmacology.....	*	*	*	*	*
3.3	Physiology/biophysics.....	0	2	66	32	0
3.4	Other biology, general.....	+	8	54	28	10
	Type of institution:					
3.1	Medical schools, total.....	6	12	52	23	6
3.2	Public.....	6	6	55	26	7
2.6	Private.....	7	38	39	14	2
3.4	Colleges and universities, total.....	+	6	49	39	6
3.5	Public.....	0	6	44	45	5
3.3	Private.....	1	8	64	18	9

1/ Perceived availability of resources was rated on a scale of 1 (excellent) to 5 (poor).

NOTE: Because of rounding, percentages may not add to 100.

KEY: + = less than 0.5 percent
* = insufficient number of cases for analysis

SOURCE: Academic Research Instrumentation and Instrumentation Needs in the Biological Sciences, National Institutes of Health: 1994